IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Harold G. Craighead et al.	Examiner: Unknown
Serial No.:	Unknown	Group Art Unit: Unknown
Filed:	Herewith	Docket: 1153.032US1
Title:	MONOLITHIC NANOFLUID SIEVING STRUCTURES FOR DNA MANIPULATION	

PRELIMINARY AMENDMENT

Commissioner for Patents
Washington, D.C. 20231

Sir,

Prior to examination of the above-referenced case, please amend the above-identified patent application as follows:

In the Specification

Please substitute page 1, paragraph 1 for the paragraph in the appendix entitled "Clean Version of Page 1, Paragraph 1." Specific amendments to page 1, paragraph 1 are detailed in the following marked-up paragraph:

This application is a continuation of International Patent Application No. WO 00/00012, filed January 12, 2000,which [The present application] claims the benefit of Provisional Application No. 60/115,854, filed January 13, 1998, and entitled "Monolithic Nanofluid Sieving Structures for DNA Manipulation", the disclosure of which is hereby incorporated herein by reference.

Please substitute the claim set in the appendix entitled Clean Version of Pending Claims for the previously pending claim set. The substitute claim set is intended to reflect the addition of new claims 25-40. The specific amendments to individual claims are detailed in the following marked up set of claims.

25. (New) A method of forming a fluidic system, the method comprising:
forming a patterned sacrificial layer on a substrate;
forming a ceiling layer on the patterned sacrificial layer; and
removing the patterned sacrificial layer.

26. (New) The method of claim 25 wherein the substrate comprises a floor layer forming a floor of the fluidic devices.

27. (New) A method of forming a fluidic system, the method comprising:
forming a patterned sacrificial layer on a substrate;
forming a ceiling layer on the patterned sacrificial layer;
forming access holes through the ceiling layer to the patterned sacrificial layer; and
removing the patterned sacrificial layer via the access holes.

28. (New) The method of claim 27 wherein the fluidic system is defined by the ceiling layer and substrate.

30. (New) The method of claim 27 wherein the substrate comprises a floor layer forming a floor of the fluidic system.

31. (New) A method of forming fluidic system s, the method comprising:
forming a patterned sacrificial layer on a substrate;
forming a ceiling layer on the patterned sacrificial layer;
forming access holes through the ceiling layer to the patterned sacrificial layer;
removing the patterned sacrificial layer via the access holes; and
covering the access holes such that the fluidic systems are defined by the ceiling layer and substrate.

32. (New) The method of claim 31 wherein the substrate comprises a floor layer forming a floor of the fluidic systems.

33. (New) The method of claim 31 wherein the ceiling layer comprises a dielectric material.

34. (New) The method of claim 31 wherein the sacrificial layer comprises amorphous silicon or polysilicon.

35. (New) The method of claim 31 wherein the fluidic systems comprise channels.

36. (New) The method of claim 31 and further comprising forming further fluidic devices on top of the already formed fluidic systems and forming interconnects therebetween.

37. (New) The method of claim 31 wherein the layers are formed using chemical vapor deposition.

38. (New) The method of claim 31 wherein the sacrificial layer is removed by providing an etchant through the access holes.

39. (New) The method of claim 38 wherein the etchant comprises tetramethyl ammonium hydroxide.

40. (New) A method of forming fluidic devices, the method comprising:
depositing sacrificial layer on a substrate;
lithographically patterning the sacrificial layer;
depositing a ceiling layer on the patterned sacrificial layer;
forming access holes through the ceiling layer to the patterned sacrificial layer;
etching the patterned sacrificial layer via the access holes; and
oxidizing the access holes.

CONCLUSION

The Examiner is invited to telephone Applicant's attorney 612- 373-6972 to facilitate prosecution of this application.

If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

Respectfully submitted,

HAROLD G. CRAIGHEAD ET AL.

By their Representatives,

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Date 7-13-2001 By _____

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"Express Mail" mailing label number: EL721295857US
Date of Deposit: July 13, 2001
This paper or fee is being deposited on the date indicated above with the United States Postal Service pursuant to 37 CFR 1.10, and is addressed to The Commissioner for Patents, Box Patent Application, Washington, D.C. 20231.

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WD # 386162

Clean Version of Pending Claims

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1. A method for fabricating a fluidic system, comprising:

depositing a floor layer on the top surface of a substrate;

depositing a sacrificial layer on the top surface of said floor layer;

patterning said sacrificial layer to define in the sacrificial layer the shape of a desired fluid working gap;

depositing a ceiling layer to cover said sacrificial layer; and

removing said sacrificial layer from between said floor layer and said ceiling layer to produce said working gap.

2. The method of claim 1, wherein removing said sacrificial layer includes:

providing at least one access hole leading to said sacrificial layer; and

etching said sacrificial layer through said at least one access hole.

3. The method of claim 2, wherein providing said at least one access hole includes forming at least one hole through said ceiling layer to said sacrificial layer.

4. The method of claim 3, further including depositing a sealing layer over said ceiling layer to close said at least one access hole.

5. The method of claim 1, wherein patterning includes:

defining in said sacrificial layer the boundaries of a fluid chamber working gap; and

defining within the boundaries of said fluid chamber a multiplicity of holes extending through said sacrificial layer to said dielectric floor layer.

6. The method of claim 5, wherein depositing said ceiling layer includes depositing the ceiling layer in said multiplicity of holes to define obstacles in said working gap.

7. The method of claim 6, wherein removing said sacrificial layer includes etching said sacrificial layer between said obstacles in said working gap to produce an artificial gel.

8. The method of claim 1, further including, after depositing said dielectric ceiling layer:

patterning and etching said ceiling layer to form a ridge waveguide intersecting the location of a desired fluid working gap;

patterning and etching said ceiling layer to define at least one access hole leading to said sacrificial layer; and

thereafter removing said sacrificial layer by etching.

9. A method for fabricating a multilevel fluidic device, comprising:

forming a first floor layer; depositing a first sacrificial layer on the top surface of said floor layer;

patterning said sacrificial layer to define in the sacrificial layer the shape of a desired fluid working gap;

depositing a ceiling layer to cover said sacrificial layer;

patterning said second sacrificial layer to define in the second sacrificial layer a second desired fluid gap;

depositing a second ceiling layer to cover said second sacrificial layer; and

removing said sacrificial layers to produce multilevel working gaps.

10. The method of claim 9, further including depositing additional patterned sacrificial and ceiling layers sequentially to produce additional working gap levels.

11. The method of claim 10, further including producing at least one vertical connector hole through a ceiling layer to interconnect adjacent sacrificial layers.

12. The method of claim 11, further including producing at least one vertical connector hole through each ceiling layer that receives a sacrificial layer on each level to the sacrificial layer on a next adjacent layer.

13. The method of claim 12, wherein removing said sacrificial layers includes:

providing at least one access hole leading to at least one of said sacrificial layers; and

etching all said sacrificial layers through said at least one access hole and said at least one vertical connector between each level.

14. The method of claim 13, wherein providing said at least one access hole includes forming at least one access hole through the topmost ceiling layer to the sacrificial layer covered by said topmost ceiling layer.

15. The method of claim 14, further including depositing a sealing layer over said second ceiling layer to close said at least one access hole.

16. The method of claim 9, wherein patterning includes:

defining in at least one of said sacrificial layer and said second sacrificial layer the boundaries of at least one fluid chamber working gap; and

defining within the boundaries of said at least one fluid chamber a multiplicity of holes extending through a corresponding sacrificial layer.

17. The method of claim 16, wherein depositing said first and second dielectric ceiling layers includes depositing the ceiling layer in said multiplicity of holes to define obstacles in said at least

one fluid working gap.

18. The method of claim 17, wherein removing said sacrificial layer and said second sacrificial layer includes etching said between said obstacles in said at least one working gap to produce an artificial gel.

19. The method of claim 9, further including, after depositing said ceiling layer:

patterning and etching said ceiling layer to form a ridge waveguide intersecting the location of a desired fluid working gap; and

patterning and etching said ceiling layer to define at least one access hole leading to said sacrificial layer.

20. The method of claim 1, further including fabricating on said substrate a device for interconnection with said working gap.

21. The method of claim 20, wherein fabricating said device is carried out by a process compatible with the process of fabricating said working gap.

22. The method of claim 21, further including interconnecting said working gap with said device to allow fluid transfer between said gap and said device.

23. A method for fabricating a nanochannel, comprising:

patterning and etching a substrate to produce a surface having a vertical sidewall intersecting the substrate at the base of the sidewall;

depositing a thin film conformal sacrificial layer on said substrate and covering said sidewall, the thickness of the thin film at the base of the sidewall having an increased thickness and width to form a sacrificial wire along the base;

removing by an unmasked RIE the thin film sacrificial layer on the sidewall and on the substrate, while leaving said sacrificial wire along said base;

depositing a ceiling layer on said substrate and said sidewall and covering said wire; and

removing said sacrificial wire to produce a nanochannel between said substrate, sidewall, and ceiling layer.

24. A method for forming a nanochannel, comprising:

depositing a thin film silicon sacrificial layer on a substrate;

patterning said silicon layer to define a sacrificial wire having the shape of a desired nanochannel;

oxidizing the patterned sacrificial silicon layer to reduce the width and height of the sacrificial wire bay consuming silicon from the surface of the wire to form a silicon oxide coating; and

removing the sacrificial wire from within said silicon oxide coating to produce a nanochannel.

25. (New) A method of forming a fluidic system, the method comprising:

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removing the patterned sacrificial layer via the access holes; and

covering the access holes such that the fluidic systems are defined by the ceiling layer and substrate.

32. (New) The method of claim 31 wherein the substrate comprises a floor layer forming a floor of the fluidic systems.

33. (New) The method of claim 31 wherein the ceiling layer comprises a dielectric material.

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36. (New) The method of claim 31 and further comprising forming further fluidic devices on top of the already formed fluidic systems and forming interconnects therebetween.

37. (New) The method of claim 31 wherein the layers are formed using chemical vapor deposition.

38. (New) The method of claim 31 wherein the sacrificial layer is removed by providing an etchant through the access holes.

39. (New) The method of claim 38 wherein the etchant comprises tetramethyl ammonium hydroxide.

40. (New) A method of forming fluidic devices, the method comprising:
depositing sacrificial layer on a substrate;
lithographically patterning the sacrificial layer;
depositing a ceiling layer on the patterned sacrificial layer;
forming access holes through the ceiling layer to the patterned sacrificial layer;
etching the patterned sacrificial layer via the access holes; and
oxidizing the access holes.

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CLEAN VERSION OF AMENDED SPECIFICATION PARAGRAPHS

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